

## Institute for Multiscale Materials Studies



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## Uncertainty Quantification for Performance Prediction and Decision-Making in Engineered Systems

**Tuesday, May 15, 2012**

**10:00 A.M.**

**TA-3, Bldg. 4200, Suite 101A, Access Grid Conference Room**

**Abstract:** This talk will deal with current research activities regarding uncertainty quantification in performance prediction and risk assessment of engineered systems. Model-based simulation becomes attractive for systems that are too large and complex for full-scale testing. However, model-based simulation involves many approximations and assumptions, and thus confidence in the simulation result is an important consideration in risk-informed decision-making. Sources of uncertainty are both aleatory and epistemic, stemming from natural variability, information uncertainty, and modeling approximations. The presentation will draw on illustrative problems in aerospace, mechanical, civil, and environmental engineering disciplines to discuss

(1) recent research on quantifying various types of errors and uncertainties, particularly focusing on data uncertainty and model uncertainty (both due to model form assumptions and solution approximations); (2) possible directions for integrating information from multiple sources (models, tests, experts), multiple model development activities (calibration, verification, validation), and multiple formats; and (3) opportunities for using uncertainty quantification in risk-informed decision-making throughout the life cycle of engineered systems, such as testing, design, operations, health and risk assessment, and risk management.

**Bio:** Professor Sankaran Mahadevan has more than twenty-five years of research and teaching experience in reliability and risk analysis methods, design optimization, structural health monitoring, and model verification, validation and uncertainty quantification (V&V and UQ) methods. His research has been extensively funded by NSF, NASA, FAA, DOE, DOD, DOT, General Motors, Chrysler, Union Pacific, American Railroad Association, and Sandia, Idaho, Los Alamos, and Oak Ridge National Laboratories. His research contributions are documented in more than 130 journal articles and numerous other publications, including two textbooks on reliability methods. He has directed 30 Ph.D. dissertations and 22 M.S. theses, and has taught many industry short courses on reliability and risk analysis methods.

Professor Mahadevan obtained his B. Tech from the Indian Institute of Technology, Kanpur, his M.S. from Rensselaer Polytechnic Institute, Troy, NY, and his Ph.D. from the Georgia Institute of Technology, Atlanta, GA.